

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER

## **INTRODUCTION**

NASA Engineering Standards Products are standards, specifications, and handbooks that are developed under the sponsorship of the NASA Chief Engineer, and managed by the NASA Technical Standards Program (NTSP).

## **PURPOSE**

NASA Engineering Standards are developed to:

- a. Promote interoperability among NASA programs/projects by developing common NASA Technical Standards.
- b. Capture and preserve engineering lessons learned and best practices.
- c. Facilitate the infusion of technology into all NASA programs/projects.

NASA Engineering Standards will be developed based on engineering lessons learned, as well as proven new technology. Development and testing of new technology are not within the scope of the NTSP.

## **DEFINITIONS**

Definitions of NASA Engineering Standards are as follows:

- **Standards (STD)** establish uniform engineering and technical requirements for processes, procedures, practices, and methods that have been endorsed as standard, including requirements for selection, application, and design criteria of an item. Within the definition given in OMB Circular No. A-119, this means (1) common and repeated use of rules, conditions, guidelines, or characteristics for products or related processes and production methods, and related management systems practices; and (2) the definition of terms; classification of components; delineation of procedures; specification of dimensions, materials, performance, designs, or operations; measurement of quality and quantity in describing materials, processes, products, systems, services, or practices; test methods and sampling procedures; or descriptions of fit and measurements of size or strength.
- **Specifications (SPEC)** are prepared specifically to support acquisition, which clearly and accurately describes essential technical requirements for purchased items. Procedures necessary to determine that the specification requirements have been met are also included.
- **Handbooks (HDBK)** are guidance documents that enhance user awareness by providing engineering information; lessons learned; possible options to address technical issues; classification of similar items, materials, or processes; and interpretive direction and techniques.

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

**APPROACH**

NASA Engineering Standards shall be proposed, prepared, reviewed, approved, and released in accordance with the Process for Development of NASA Engineering Standards Sponsored by the NASA Chief Engineer. ***The Online NASA Technical Standards Management System (NTSMS) at <http://standards.nasa.gov> shall be utilized for STAGE 1. To access NTSMS, register/logon to NASA ACCESS and click “NASA Technical Standards Management System.”***

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

<b>Stage 1</b>	<b>Stage 2</b>	<b>Stage 3</b>	<b>Optional Stage (If Necessary)</b>	<b>Stage 4</b>
<b>Proposal Submission, NTSWG<sup>1</sup> Member Evaluation, NTSP Manager Disposition</b>	<b>Topic Working Group (TWG) Formulation; Working Draft Development</b>	<b>Agencywide Review of Draft Standard, Formal Center Concurrence, HQ Mission Concurrence</b>	<b>Conflict Resolution by EMB/NASA Chief Engineer</b>	<b>NASA Chief Engineer Approval, Document Released</b>
<ul style="list-style-type: none"> <li>• Scope/Description</li> <li>• Documents to be Replaced, If Any</li> <li>• Need, Benefits, Value Added</li> <li>• Existing VCS/Other Government/NASA-Developed Standards Assessment</li> <li>• Available NASA Expertise</li> <li>• NTSWG Proposal Review and Evaluation</li> <li>• NTSP Manager Disposition of Proposal and Assignment of Document Number; TWG Chair Named</li> <li>• Proceed to Stage 2</li> </ul>	<ul style="list-style-type: none"> <li>• Center Interest Solicited from NTSWG (Center Option); TWG Members Assigned by TWG Chair</li> <li>• Set Development Schedule</li> <li>• Ensure TWG Compliance with Export Control Policy and Procedures</li> <li>• Review of Lessons-Learned Sources for Incorporation of Technical Contents into the Draft</li> <li>• Working Draft Developed by TWG; Preliminary Export Control Review (Recommended)</li> <li>• TWG Progress Provided to NTSWG</li> <li>• Proceed to Stage 3</li> </ul>	<ul style="list-style-type: none"> <li>• Draft sent by TWG Chair to NTSWG Chair</li> <li>• Draft Sent to NTSWG Members For Centerwide Reviews (Includes Program/Project Offices and Directorates)</li> <li>• NTSWG Members Obtain Center Comments/ Concurrences and Submit to TWG Chair and copy to NTSP Manager</li> <li>• Comments Resolved and Incorporated into Draft. Resolution Matrix Developed by TWG</li> <li>• Draft Document Formatted and Edited by NTSP Office</li> <li>• Final Draft/Resolution Matrix Completed and sent to NTSWG</li> <li>• Obtain EMB<sup>2</sup> and HQ Mission Concurrence of Final Draft and Resolution Matrix Concurrently</li> <li>• Proceed to Stage 4<sup>3</sup></li> </ul>	<ul style="list-style-type: none"> <li>• NTSWG and TWG Chairs Present Issues to EMB</li> <li>• Issues Resolved by EMB and NASA Chief Engineer</li> <li>• Resolution to TWG for Finalization</li> <li>• Final Formatting and Editing by NTSP Office</li> <li>• Formal Center Concurrence by EMB Members, and Simultaneously, Obtain HQ Mission Concurrence of Final Draft and Resolution Matrix</li> <li>• Proceed to Stage 4</li> </ul>	<ul style="list-style-type: none"> <li>• Export Control Approval</li> <li>• NASA Chief Engineer Review and Approval</li> <li>• Document Released as NASA Preferred Technical Standard</li> <li>• Document Published on the NTSP Website</li> <li>• Agencywide Notification That Document Has Been Approved</li> </ul>

<sup>1</sup>NASA Technical Standards Working Group (Formerly Engineering Standards Steering Council)

<sup>2</sup>Engineering Management Board (Formerly Engineering Management Council)

<sup>3</sup> If Comments Cannot be Resolved, Proceed to the Optional Stage

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

**DETAILS OF EACH STAGE**

**1. STAGE 1: Proposal Submission, NASA Technical Standards Working Group (NTSWG) Member Evaluation, NTSP Manager Disposition**

*NOTE: Any NASA employee or contractor within the <nasa.gov> domain may prepare/submit a proposal to develop a NASA Engineering Standard, including conversion of a Center-developed standard (online in the NTSMS by accessing “Prepare and Submit Proposal to Develop a NASA Engineering Standards Product”).*

1.1 Prior to submittal of a proposal, the proposal author shall consider the following:

- a. Determine the availability of any existing applicable national or international voluntary consensus standards (VCS).
- b. Recommend suitable VCS(s) for Agency adoption if any exist, rather than proposing development of a NASA Engineering Standard. Add Application Note(s) if valid reservations exist concerning the use of the VCS if adopted.
- c. Research the existence of similar NASA or other Government standards.
- d. In the proposal, justify the development of a new NASA Engineering Standard over an existing standard.

*NOTE: Providing detailed information, using the guidelines in the proposal, is imperative to ensure adequate evaluation and approval of the proposal. The scope/description should be thorough, including the need for the standard and benefits/value added to NASA; provide documents to be replaced by developing a NASA standard; include involvement of others in preparing the standard and available NASA expertise; and submit accurate estimate of time and effort for development. Access to “View Submitted Proposals” and the “Status of Proposals” is provided from NTSMS.*

1.2 To ensure the need to develop a NASA Engineering Standard versus using an existing standard, the NTSP Manager shall, via email:

- a. Request clarification from the proposal author, if needed.
- b. Decline the proposal, identifying reasons to the proposal author.
- c. Send the proposal to the NTSWG members for evaluation, specifying the due date.

*NOTE: Copies of emails will be sent to the proposal author’s NTSWG member and supervisor.*

1.3 The proposal author shall access the proposal (returned to draft status), make modifications, and resubmit the proposal for screening; or delete the draft proposal from the system.

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

1.4 The NTSWG members shall review and evaluate (record) the proposals based on the following factors:

- a. Is proposal in reviewer's area of expertise?
- b. Does proposal duplicate an existing Government or non-Government standard or standard under development?
- c. Is adequate technology available to support preparation of the proposed standard?
- d. Grade points of 1-10 are assigned to weighted criteria:

Weighting	Criteria
25%	Degree Technology has been developed
25%	Relative importance to the NASA Mission
25%	Degree that the approach is understandable and adequate
15%	Timeframe for accomplishing the proposal effort
10%	Adequacy of the estimated effort

*NOTE: Comments relative to the proposal may be submitted by evaluators. NTSWG members may send the proposal for evaluation by others at their Center. The duration of this review is at the discretion of the NTSP Manager. The proposal author will receive an email notification each time an evaluation is submitted to the NTSP Manager.*

1.5 The proposal author shall respond to evaluation comments via a link in the email notification. *The evaluator will be notified of the response via email and given opportunity to respond.*

1.6 Following evaluation of the proposal, the NTSP Manager shall take one of the following actions:

- a. Approve the proposal. *The approval email (record) is the author's authority to proceed with development of the proposed standard as stated in the proposal. Approval is contingent upon the TWG Chair's selection of at least three TWG members from NASA Centers. The Chair is encouraged to include discipline reviewers from industry/academia as well. The document number for the proposed standard is assigned. (To obtain a time charge code for this standards development activity, contact your Center's NTSWG member.) The NTSP Manager has the authority to approve a proposal without NTSWG member evaluation if circumstances demand such action.*

(1) The proposal author shall become the Topic Working Group (TWG) Chair unless unavailable.

(2) If unavailable, the NTSP Manager shall appoint the TWG Chair.

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

- b. Disapprove the proposal, stating rationale. *Reasons for disapproving the proposal will be included in the email notification (record).*
- c. Place the proposal on “Hold.” *A proposal may remain in “Hold” status indefinitely at the discretion of the NTSP Manager.*

1.7 Proceed to Stage 2.

**2. STAGE 2: Topic Working Group (TWG) Formulation; Working Draft Development**

**[NOTE: The Online NASA Technical Standards Management System (NTSMS) at <http://standards.nasa.gov> shall be utilized for section 2.1. To access the system, register/logon to NASA ACCESS and click “NASA Technical Standards Management System.” Then click “Topic Working Group”.]**

2.1 A Center’s interest in participating in the development of the proposed standard is solicited from the NTSWG members in the email announcing approval of the proposal. The NTSWG members shall send the TWG Chair the name, email address, phone number, and NASA Center of those interested in participating.

2.2 If a Technical Discipline Working Group/Community of Practice for the discipline is already established/chartered, the Technical Discipline Working Group/Community of Practice Chair shall contact the group for support in developing the standard. Additional Center participation is optional in this case.

2.3 The TWG Chair shall:

- a. Assign TWG members and enter their information, along with that of the discipline reviewers from industry/academia, on the NTSP website. *NASA Technical Standards System users within the <nasa.gov> domain can view, but only the Chair can change TWG information. From the “TWG Members” column, the Chair adds new members by clicking “Add New Members” and completes the information. To change an existing member’s information, the Chair clicks the Center acronym, makes changes, and “Saves” the data; or clicks “Delete” to delete the information.*
- b. Establish a development schedule for the standard and send it to the NTSP Manager.
- c. Provide Progress Reports of the document development status to the NTSP Manager at a minimum of every 3 months, or at earlier intervals if requested by the NTSP Manager. *The reports may include lessons-learned sources reviewed, status of development, changes in schedule for development, delays, etc.*

2.4 The TWG shall:

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

- a. Comply with US Export Control requirements in accordance with NASA policy and procedures prior to and during development of the standard. Due diligence shall be exercised by the Exporter of the document, as well as by the recipients of the document!
- b. Review lessons-learned sources for incorporation of technical contents into the draft standard; many sources are available from the NASA Technical Standards System at <http://standards.nasa.gov>.
- c. Develop the working draft of the standard, specification, or handbook utilizing the templates provided in the NASA Technical Standards System under "NASA Technical Standards Management System." *The TWG may utilize the NTSP online tools for draft document development and preliminary review by contacting the NTSP Manager.*
- d. When a draft standard is in development or being distributed for preliminary reviews ***prior to obtaining Export Control/Distribution authorization***, ensure that the Distribution Statement on the Title Page of the draft document reads as follows: THIS STANDARD HAS **NOT** BEEN REVIEWED FOR EXPORT CONTROL RESTRICTIONS; CONSULT YOUR CENTER/HEADQUARTERS EXPORT CONTROL PROCEDURES/AUTHORITY PRIOR TO DISTRIBUTION OF THIS DOCUMENT. *A preliminary Export Control review of the working draft is highly recommended at the earliest practical time.*
- e. Conduct preliminary reviews of the working draft, as necessary, to facilitate official review and approval.

2.5 Proceed to Stage 3.

**3. STAGE 3: Agencywide Review of Draft Standard, Formal Center Concurrence, HQ Mission Concurrence**

3.1 The TWG Chair shall submit the TWG's draft document to the NTSP Manager, requesting Agencywide review of the draft.

3.2 The NTSP Manager shall:

- a. Assign an action to the NTSWG members to conduct Centerwide reviews of the draft (designated as Draft 1) relative to the standard's technical accuracy and adequacy, usually due within 30 days (record).
- b. During this review, ensure the draft is technically edited/formatted and sent to the TWG Chair prior to the review due date.

3.3 NTSWG members shall:



PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

- a. Be aware of document distribution restrictions (stated in the distribution block on the title page).
- b. Conduct technical reviews of each draft document by the Center's Program/Project Offices and Directorates/Organizations to ensure accuracy and adequate technical review by the Agency. Following review, submit one of the following dispositions (records) for the Center to the NTSP Manager and the TWG Chair:
  - (1) Concur.
  - (2) Concur with Comments; provide comments with specific change recommendations.
  - (3) Nonconcur; provide rationale.
- c. Submit to the NTSP Manager and to the TWG Chair the names of specific Program/Project Offices and Directorates/Organizations and names of persons who reviewed the draft document, as well as their comments or a notation that a review occurred but no comments were received.

3.4 The TWG Chair shall:

- a. Resolve comments with the Center reviewers and prepare the resolution matrix (record) in accordance with TABLE 3.4-1, usually within a 30-day period.
- b. Indicate disposition of each comment received by entering one of the following, and document the commenter's concurrence with the resolution in the resolution matrix:
  - (1) Accepts the comment as is (Accept As-Is).
  - (2) Accepts the comment with modifications specifically stated (Accept w/Mods).
  - (3) Does not accept the comment for reasons provided (Not Accepted).
- c. If comment resolution does not result in changes to the document, send the final resolution matrix to the NTSP Manager. Proceed to 3.5; otherwise, proceed to 3.4 d.
- d. If comment resolution results in changes to the document:
  - (1) Incorporate those changes into the NTSP Office-edited document.
  - (2) Submit the redlined Draft 2, revised final document (in Word format), and the resolution matrix (as shown in Table 1) to the NTSP Manager.
  - (3) Ensure all comments submitted and their dispositions are listed in the resolution matrix. Proceed to 3.5; otherwise, proceed to 3.4 e.



PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

- e. If comments cannot be resolved by the TWG Chair with the reviewer and NTSWG member, notify the NTSP Manager to promote resolution. If resolution cannot be reached, proceed to the Optional Stage.

3.5 The NTSP Manager shall issue an action (record) to NTSWG members to review the final draft and the resolution matrix. A redlined version of the final draft shall also be provided.

3.6 The NTSWG member shall:

- a. Obtain formal concurrence from the represented Center's Engineering Management Board (EMB) member, documented via formal memorandum or email from the EMB member (records), if the NTSWG member agrees with the final draft/resolution matrix, and send to the NTSP Manager; proceed to 3.7 d.
- b. Notify the NTSP Manager immediately if there is not Center agreement with the final draft and resolution matrix; proceed to 3.7 a, b, and c.

3.7 The NTSP Manager shall:

- a. Notify NTSWG members to stop obtaining formal EMB concurrence until the issues are resolved.
- b. Promote issue resolution. If resolution cannot be accomplished, proceed to the Optional Stage; otherwise, proceed to 3.7.c.
- c. Notify NTSWG members of issue resolution, provide final (and redlined) document and revised resolution matrix if changes resulted, and request NTSWG members to obtain EMB concurrence. Return to 3.6 a.
- d. Forward the final document, the final resolution matrix, and formal EMB concurrence from all Centers/JPL (records) to the NASA Chief Engineer's Office.

3.8 The NASA Chief Engineer's Office shall obtain HQ Mission concurrence (if warranted) and send a courtesy copy of the document to the NASA Engineering and Safety Center, resolve conflicts/issues resulting from this review, ensure the final document includes any changes, and ensures that this review documentation (records) is added to the approval package.

*NOTE: When feasible, EMB and Mission concurrences will be obtained concurrently.*

3.9 Proceed to Stage 4.

**4. OPTIONAL STAGE: Conflict Resolution by EMB/NASA Chief Engineer**

4.1 The NTSWG and TWG Chairs shall present to the EMB conflicts and issues that cannot be resolved between the NTSWG and TWG. The following information shall be included:

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

- a. The issue(s) resulting in the nonconcurrency.
- b. The approach used by the TWG Chair to resolve the issue(s) and the outcome of that approach.
- c. The reason(s) the issue(s) remains unresolved, with pros and cons listed, and the recommendation of the TWG Chair.

4.2 The EMB members and the NASA Chief Engineer shall resolve conflicts and issues.

4.3 If changes to the document result, the TWG Chair shall prepare the final document and resolution matrix and send to the NTSP Manager.

4.4 EMB members shall submit formal Center concurrence (record) to the NTSP Manager.

4.5 The NTSP Manager shall forward the final document, the final resolution matrix, and formal EMB concurrence from all Centers/JPL (records) to the NASA Chief Engineer's Office.

4.6 The NASA Chief Engineer's Office shall obtain HQ Mission concurrence (if warranted) and send a courtesy copy of the document to the NASA Engineering and Safety Center, resolve conflicts/issues resulting from this review, ensure the final document includes any changes, and ensures this review documentation (records) is added to the approval package.

*NOTE: When feasible, EMB and Mission concurrences will be obtained simultaneously.*

4.7 Proceed to Stage 4.

**5. STAGE 4: NASA Chief Engineer Approval, Document Released**

5.1 The TWG Chair shall obtain export control/distribution authorization utilizing NASA Form 1676, NASA Scientific and Technical Document Availability Authorization, for the final document (record) and verify that the Distribution Statement on the document is correct.

5.2 The NTSP Manager shall submit the document approval package consisting of the final NASA Engineering Standard, final resolution matrix, approved NASA Form 1676, EMB concurrence, and HQ Mission concurrence (if warranted) to the NASA Chief Engineer for review and approval.

5.3 The NASA Chief Engineer shall review the document package for technical accuracy and adequacy and perform one of the following:

- a. Provide comments; proceed to 5.4 a.
- b. Approve the document and return the approved package to the NTSP Manager; proceed to 5.4 c, d, and e.

PROCESS FOR DEVELOPMENT OF NASA ENGINEERING STANDARDS  
SPONSORED BY THE NASA CHIEF ENGINEER (Continued)

- c. Disapprove the document and return the document package with rationale for disapproval to the NTSP Manager; proceed to 5.4 b.

5.4 The NTSP Manager shall:

- a. If comments change the document text, incorporate those changes; prepare the final document and resolution matrix; coordinate re-approval of the NASA Form 1676, if warranted; and send the final NASA Engineering Standard to the NASA Chief Engineer; return to 5.3.
- b. Notify the TWG Chair and NTSWG members that the document was disapproved (with rationale) and file the disapproved package (record), thus ending the process.
- c. Publish the approved document and file the document approval package (record).
- d. Enter the document information in the Standards Update Notification System (SUNS) and publish the electronic version of the approved NASA Engineering Standard in the NASA Technical Standards System as a NASA Preferred Technical Standard (record). Any Application Notes required to publish this standard shall also be submitted at this time.
- e. Ensure the approved NASA Form 1676 for the final document is on file prior to providing access to the NASA Engineering Standard. Based on this approval, the document will be either publicly accessible, or controlled using IP addresses and requests approved by the NTSP Manager in accordance with distribution limitations. An Export Controlled NASA Engineering Standard shall not be linked to the NASA Technical Standard System index; however, contact information for obtaining the Standard shall be provided.

5.5 If a NASA Engineering Standard resides on another server and is linked to the NASA Technical Standards System for accessibility, the Office of Primary Responsibility (OPR) shall be responsible for maintaining the record of Export/Distribution Control authorization and for providing a copy to the NTSP Manager.

5.6 The NTSP Office shall distribute an Agencywide announcement (record) regarding the document's approval and its availability in the NASA Technical Standards System.

5.7 The Office of Primary Responsibility Designee shall maintain the published NASA Engineering Standard, including revision, revalidation, and cancellation when no longer needed.

**RESOLUTION MATRIX FOR DRAFT #**  
**Insert Document No., Insert Document Title**

Date:

Prepared By:

								TWG Chair/OPR Designee	
Comment No.	Date Comment Received	Center	Comment/Review Source(s) [Include Mail Code/Name & Phone No.]	Comment Section	Center Disposition	Comments and Recommended Changes		Comment Disposition	Comment Disposition Rationale, if Not Accepted
						From:	To:		
1	10/01/2004	MSFC	EX/Jane Doe [NTSWG Member], 555-222-1111, <a href="mailto:jane.doe@nasa.gov">jane.doe@nasa.gov</a>		Concur w/ Comments				
	09/28/2004		PZ/H. Green, XYZ Project, 888-999-5555, <a href="mailto:h.green@xyz.com">h.green@xyz.com</a>	4.1.2	Concur w/ Comments	Strength. Requirements for structural strength test factors, restrictive conditions concerning testing of non-metallic structures...	Strength. Requirements for structural strength test factors and justification, . . .	Accepted	
2	10/9/2004	GSFC	AB/John Doe [NTSWG Member], 555-333-4444, <a href="mailto:john.doe@nasa.gov">john.doe@nasa.gov</a>		<u>Nonconcur</u>				
3	10/03/2004	GSFC	PX/J. Black, ABC Program, 222-111-7777, <a href="mailto:j.black@abc.com">j.black@abc.com</a>	5.2.5	Nonconcur The reference of 60 p/s cites requirements that are high and exceed the mission requirements for payloads.	--	--	Not Accepted	The requirement of 60 p/s was verified by numerous tests conducted by an independent contractor. Comment satisfactorily resolved with Joe Black on 10/05/2004.

TABLE 3.4-1. Resolution Matrix